so distinct that they evidently indicate different species. Mr. Murray believes, however, that only one form is met with on one sphere; and that in order to produce the numerous forms figured by Hæckel and Oscar Schmidt, all of which, and many additional varieties, he has observed, the spheres must vary in age and development, or in kind. Their constant presence in the surface-net, in surface-water drawn in a bucket, and in the stomachs of surface animals, sufficiently prove that, like the ooze-forming foraminiferes, the coccoliths and rhabdoliths, which enter so largely into the composition of the recent deep-sea calcareous formations, live on the surface and at intermediate depths, and sink to the bottom after death. Coccospheres and rhabdospheres have a very wide but not an unlimited distribution. From the Cape of Good Hope they rapidly decreased in number on the surface, and at the bottom as we progressed southwards. The proportion of their remains in the Globigerina ooze near the Crozets and Prince Edward Island was comparatively small; and to this circumstance the extreme clearness and the unusual appearance of being composed of Globigerinæ alone was probably mainly due. We found the same kind of ooze nearly free from coccoliths and rhabdoliths in what may be considered about a corresponding latitude in the north, to the west of Faröe.

Before leaving the subject of the modern chalk, it may be convenient to pass on to stations 158, 159, and 160, on March 7th, 10th, and 13th, on our return voyage from the ice. The first two of these, at depths of 1,800 and 2,150 fathoms respectively, are marked on the chart "Globigerina ooze;" and it will be observed that these soundings nearly correspond in latitude with the like belt which we crossed going southwards; the third sounding at a depth of 2,600 fathoms is marked "red clay."

According to our present experience the deposit of Globigerina ooze is limited to water of a certain depth, the extreme limit of the pure characteristic formation being placed at a depth of somewhere about 2,250 fathoms. Crossing from these shallower regions occupied by the ooze into deeper soundings, we find universally that the calcareous formation gradually passes into and is finally replaced by an extremely fine pure clay, which occupies, speaking generally, all depths below 2,500 fathoms, and consists almost entirely of a silicate of the red oxide of iron and alumina. The transition is very slow, and extends over several hundred fathoms of increasing depth; the shells gradually lose their sharpness of outline and assume a kind of "rotten" look and a brownish colour, and become more and more mixed with a fine amorphous red-brown powder, which increases steadily in proportion until the lime has almost entirely disappeared. This brown matter is in the finest possible state of subdivision, so fine that when, after sifting it to separate any organisms it might contain, we put it into jars to settle, it remained for days in suspension, giving the water very much the appearance and colour of chocolate.

In indicating the nature of the bottom on the charts, we came, from experience and without any theoretical consideration, to use three terms for soundings in deep water. Two of these, Gl. oz. and r. cl., were very definite, and indicated strongly marked formations, with apparently but few characters in common; but we frequently got soundings which we could not exactly call either "Globigerina ooze" or "red clay;" and before we were fully aware of the nature of these we were in the habit of indicating them as "grey ooze" (gr. oz.) We now recognise the "grey ooze" as an intermediate stage between the Globigerina ooze and the red clay; we find that on one side as it were of an ideal line, the red clay contains more and more of the material of the calcareous ooze, while on the other the ooze is mixed with an increasing proportion of "red clay.'

Although we have met with the same phenomenon so frequently that we were at length able to predict the nature of the bottom from the depth of the sounds with absolute certainty for the Atlantic and the Southern Sea, we had perhaps the best opportunity of observing it in our first section across the Atlantic, between Teneriffe and St. Thomas. The first four stations on this section, at depths from 1,525 to 2,220 fathoms, show Globigerina ooze. From the last of these, which is about 300 miles from Teneriffe, the depth gradually increases to 2,740 fathoms at 500, and 2,950 fathoms at 750 miles from Teneriffe. The bottom in these two soundings might have been called "grey ooze;" for although its nature has altered entirely from the Globigerina ooze, the red clay into which it is rapidly passing still contains a considerable admixture of carbonate of lime.

The depth goes on increasing to a distance of 1,150 miles from Teneriffe, when it reaches 3,150 fathoms; there the clay is pure and smooth, and contains scarcely a trace of lime. From this great depth the bottom gradually rises, and with decreasing depth the grey colour and the calcareous composition of the ooze return. Three soundings in 2,050, 1,900, and 1,950 fathoms on the "Dolphin Rise," gave highly characteristic examples of the Globigerina formation. Passing from the middle plateau of the Atlantic into the western trough with depths a little over 3,000 fathoms, the red clay returned in all its purity: and our last sounding in 1,420 fathoms before reaching Sombrero, restored the Globigerina ooze with its peculiar associated fauna.

This section shows also the wide extension and the vast geological importance of the red clay formation. The total distance from Teneriffe to Sombrero is about 2,700 miles. Proceeding from east to west, we have

About 80 miles of volcanic mud and sand,
,, 350 ,, Globigerina ooze,
,, 1,050 ,, red clay,
,, 330 ,, Globigerina ooze,
,, 850 ,, red clay,
,, 40 ,, Globigerina ooze;

giving a total of 1,900 miles of red clay to 720 miles of Globigerina ooze."

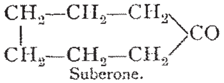
(*To be continued.*)

SCIENTIFIC SERIALS

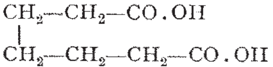
THE *Journal of the Chemical Society* for October commences with a paper, by Prof. Roscoe, On a new chloride of uranium. The new compound is the pentachloride UCl_5, obtained by passing chlorine over a heated mixture of any oxide of uranium and charcoal. If the current of chlorine is slow, the substance forms dark needle-shaped crystals with a green metallic lustre and ruby red by transmitted light. When the chlorine is passed rapidly, UCl_5 is formed as a brown powder. The compound decomposes on heating into the tetrachloride and free chlorine.—The next paper is on suberone, by C. Schorlemmer and R. S. Dale. This body is formed by distilling suberic acid with lime according to the equation—

$$2C_8H_{14}O_4 = 2CO_2 + 2H_2O + C_{14}H_{24}O_2.$$

Hexane is produced at the same time, and can be separated by fractional distillation. Pure suberone is a mobile liquid, boiling at 179° to 181°. The molecular formula is $C_7H_{12}O$, and it is oxidised by nitric acid into an acid of the formula $C_7H_{12}O_4$. The authors have examined the barium, calcium, and silver salts of this acid. The new acid has the same composition as the pimelic acid obtained by Hlasiwetz and Grabowsky from camphoric acid, but its properties are quite different, and it has been provisionally named α-pimelic acid. The authors assign the following constitutional formulæ to suberone and α-pimelic acid:—



Suberone.



$$\begin{array}{l} CH_2{-}CH_2{-}CO.OH \\ | \\ CH_2{-}CH_2{-}CH_2{-}CO.OH \end{array}$$

α-Pimelic acid.

Note on the crystalline forms of meconic and α-pimelic acids, by Dr. C. A. Burghardt.—On the action of earth on organic nitrogen, by E. C. C. Stanford. The experiments were made on mixtures of lean meat with ordinary loam-earth, and the author deduces therefrom the following conclusions:—1. Earth mixed with organic nitrogenous matter is an indifferent dryer, and, except in considerable quantity, a poor deodoriser. 2. That the mixtures continuously lose nitrogen to about the extent of 73 per cent. in five months. 3. That the loss is perhaps wholly due to decay, the nitrogen being probably evolved as ammonia. 4. That in such mixtures the earth does not act as an oxidiser, no nitrification taking place.—The remainder of the journal is devoted to abstracts from foreign periodicals, many of which have been already noticed in these columns.

Gazzetta Chimica Italiana, fascicolo vi., vii., and viii., October.—This part begins with a long and valuable paper by W. Koerner, entitled "Studies of the Isomerism of the bodies known as Aromatic Substances with six Carbon Atoms." This research has led the author to study the action of nitric acid on acetanilide giving rise to the formation of nitro-acetanilide, which is converted by potassium hydrate into a mixture of ortho- and meta-nitroaniline. Para-nitroaniline from ordinary dinitro-benzene is next treated of, then the reduction of meta-nitroaniline. Iodobenzene acted upon by nitric acid yields ortho- and meta-iodo-nitrobenzene, the first of which was converted by the action of nitro-sulphuric acid into a dinitro derivative, which, on treatment with a dilute solution of potassium hydrate, is converted into the potassium salt of ordinary dinitrophenic acid, and by the action of alcoholic ammonia into ordinary dinitro-aniline. From these reactions the author concludes that this dinitro-iodobenzene has the structural formula 1 : 2 : 4. Dinitro-iodobenzene from meta-nitro-iodobenzene has been prepared and proved to be identical with the foregoing body; at the same time a small quantity of a second dinitro compound is produced, which the author considers as the iodide of the β dinitrophenol of Huebner and Werner. The dinitro-aniline from this body has been prepared, and the constitution 1 : 2 : 6 is assigned to it. The author next enters into the consideration of this β dinitrophenol—a table comparing the fusion points of this body and its derivatives with those of the α compounds is given. The brominated derivatives of the aniline have been examined, and the constitution 1 : 2 : 4 assigned to the dibromo-aniline. A large section is next devoted to the three isomeric dibromo-benzenes; dichlorobenzene is also considered, and the three monobromo-toluenes. The action of bromine on the isomeric nitro-anilines has been studied, and constitutional formulæ are assigned to the resulting compounds. The author then goes on to consider the preparation of the new dinitrobenzene and the products of its transformations. The mono-nitro compound has been submitted to a similar study, and likewise the mono-nitro derivatives of the dichloro-, chloro-bromo-, chloro-iodo-, bromo-iodo-, and di-iodo-benzene. The next section is devoted to the constitution of the principal substitution products of phenol. The isomeric monobromophenols are first treated of, then the following bodies in succession:—dibromo-ortho-nitroanisol, the corresponding meta compound, Laurent's bromodinitrophenol, the dinitrochlorophenol of Dubois, and the corresponding bromo- and iodo compounds; finally, dinitro-para-dibromobenzene, its phenol and aniline. The three isomeric tribromobenzenes are next treated of: nitrotribromobenzene and the products of its decomposition. The constitution of the di-derivatives is discussed, and the present state of our knowledge with respect to the ortho-, para-, and meta-series of the aromatic compounds is well displayed in a series of tables. The remainder of this paper, of which the foregoing is but an imperfect outline, is entirely devoted to theoretical considerations.—The next paper is a preliminary note on the action of hydriodic acid on santonic acid, by S. Cannizzaro and D. Amato.—This is followed by a paper by the same authors on metasantonine, to which the formula $C_{15}H_{18}O_3$ is assigned.—Quantitative determination of the atomic group C_2H_3O contained in acetyl substitution products, by Fausto Sestini.—On the action of bromine on anhydrous chloral, by A. Oglialoro.—Allylate of chloral, by the same author.—Transformation of benzamide into benzoic aldehyde and alcohol, by Prof. J. Guareschi.—Action of sulphur on calcium carbonate, by E. Pollacci.—On the production of ozone by means of the electric discharge, by C. Giannetti and A. Volta.—On the necessity for searching for phosphorus in the urine in cases of poisoning, by F. Selmi. The same author contributes a paper on milk.—The concluding paper is by M. Mercadante, on the behaviour of tannic acid when used in agriculture.—The part concludes with notices of current foreign work in technical chemistry.

Bulletin de la Société d'Anthropologie de Paris, tome neuvième.—M. Dareste, in reply to the discussion which his paper on double or twin monsters (as given in a former number) had called forth, explains the nature of the observations on which his deductions were based. It would appear that after submitting nearly 8,000 hens' eggs to the process of artificial incubation, he obtained nearly 4,000 anomalies or monstrosities, but of these only about thirty were double embryos or twin monstrosities. A similar result has been observed in the case of osseous fishes; and Jacobi, who was the first to discover (in the course of the last century) the mechanism of fecundation among these fishes, had noted the proportion of twin monsters in fishes' eggs. His observations and those of Lerebouillet coincide with the result obtained by M. Dareste, that while external conditions may often determine the formation of simple monsters, they are absolutely without effect in regard to the evolutions of double monstrosities.—M. M. A. Bertrand, in a communication specially addressed to the Society, has propounded the novel hypothesis that the discovery of the manipulation of metals, as copper, tin, iron, silver, and lead, is due to Oriental peoples, with whom it was far advanced at a period when Europe was still in a state of barbarism. He, moreover, is of opinion that these arts came from a common centre by two channels, viz., the valley of the Dnieper and the valley of the Danube, in the latter of which the semi-barbarous Slavonic tribes still practise these arts very much as they first learned them from their Asiatic neighbours.—M. Hamy considers, in a short paper, the value as a distinctive palæontological character of the bifid condition of the canines in the Smeermaas jaw. He had frequently before noticed a transversal flattening in other fossil canines, and since his examination of the Smeermaas jaw he has found two other examples of this from the Quaternary period.—M. Broca discusses at length the influence of humidity on the form and dimensions of fossil crania, and deduces from his observations the general conclusions that the capacity of crania varies greatly in accordance with the hygrometric condition of their walls; that in drying, after removal from a humid soil, they undergo a considerable retraction, amounting in some instances to fully twenty cubic centimetres; that the walls of fossil crania are hygrometric; and that, consequently, no comparative observations of cranial capacity have any value unless all the crania have been exhumed for a space of many months.

THE August number of the *Bulletin de la Société d'Acclimatation de Paris* opens with a list of the various animals and plants which the society is prepared to lend to its members, with a view to establishing any new or rare forms of animal or vegetable life in different parts of the country. This is an organisation which might usefully be adopted in England.—A paper by M. B. Rico shows how varieties of Salmonidæ may be kept in enclosed waters, and points out—as Mr. Buckland has proved in England—that salmon and trout will keep in good condition in enclosed places with a good supply of food and of running water.—Dr. Turrel, in a paper entitled "Les Oiseaux et les Insectes," combats the theory of M. Perris that birds have very little effect in checking the increase of insects. He thinks that to the indiscriminate slaughter of small birds may be traced, to a certain extent, the spread of the *Phylloxera*.—Mr. R. Trimen contributes an interesting paper on the animals and useful plants of the Cape of Good Hope, from which it appears that there are no mammalia indigenous to South Africa which have been employed as beasts of burden; but the colony is rich in edible animals and valuable birds.—M. Cabonnier announces the arrival from India of several specimens of three varieties of fish never hitherto brought to Europe—the *Anabas scandens* or Climbing Perch, the Telescope Fish, and the Gourami.—The Phylloxera is the object of various notes and suggestions, with the view of providing some means of rresting its progress.

Reale Istituto Lombardo, Rendiconti, vol. 7, fasc. viii.—Prof. Giovanni Cantoni contributes a note, "Researches on Heterogenesis." Ten years ago the Academy appointed a committee to investigate spontaneous generation, which from time to time reports its experiments. Dr. Grassi and Dr. Macagno, at Asti, have devoted themselves to the question of vinous fermentation. With saccharine solutions and new wine, they obtained the cryptogams characteristic of vinous fermentation. A certain number appeared in flasks hermetically sealed and heated for half an hour to 100°, and some occurred in flasks containing air filtered through cotton-wool, and washed both in sulphuric acid and an alkaline solution. These observers affirm that raising the temperature of wine does not destroy Pasteur's germs, owing to a special combination between the liquid and the small quantity of free oxygen remaining in the sealed vessel.—The next paper, On the limits of electrical resistance in non-conductors, is by the same author.—Prof. Giovanni Zoga gives an account of the Anatomical Museum of Pavia, which contains 638 preparations, of which 38 are complete skeletons, 26 male and 12 female, varying in age from the fœtus of two months to 101 years. Most of them are Italian, though two are German, one American, one Moor, and one Egyptian. There are 200 skulls and 400 portions of different skeletons. Of these skulls only 46 are females, and although the greater part are Italian, they include representatives of the various nations of Europe, Asia, and America, and of different social grades. The author mentions peculiarities seen in the several bones, and gives measurements of the skulls.—The last article is by Dr. Guido Grassi, and is devoted to the explanation of a new reflecting balance. This is a common balance with a reflector fixed above the index. He details experiments to show the way in which it may be used, and its advantages in the physical laboratory, since the fiftieth part of a milligramme can be estimated by it quicker than by the ordinary method.

SOCIETIES AND ACADEMIES

LONDON

Physical Society, Nov. 21.—Dr. J. H. Gladstone, F.R.S., president, in the chair.—Prof. Macleod described a simple arrangement he had devised for showing internal resistance in battery cells. Two tubes about half a metre long, one of which is about twice the diameter of the other, are closed at their lower ends with corks. On the corks and within the tubes rest two discs of platinum foil connected with binding screws by platinum wires passing through the corks. The plates are covered with chloride of silver and the tubes are filled with a solution of chloride of zinc. Each tube is provided with a disc of amalgamated zinc soldered to a long insulated copper wire. The discs are cut so that they nearly fit the tubes, one being exactly double the diameter of the other, and therefore exposing four times the surface to the action of the liquid. On connecting the terminals with a galvanometer, the current will be found to increase as the distance between the zinc and platinum plates is diminished by lowering the zinc plate into the tube. In order to obtain the same deflection of the galvanometer by the narrow cell, the distance between the plates must be one-fourth those of the larger ones. The apparatus may also be used to show that opposed cells of the same kind will not produce a current. For this purpose the platinum plates are connected together and the two zinc plates joined to the galvanometer. No current will flow, whatever the distance between the plates.—Mr. James Baillie Hamilton, of University College, Oxford, made a communication on the application of wind to stringed instruments. Mr. Hamilton commenced with a short history of the efforts which had been made to bring the Eolian harp under human control, and explained how he himself had taken up the matter from Mr. John Farmer on leaving Harrow School. Mr. Farmer had succeeded in getting wind to do the work of a bow upon a string by attaching a reed to the end of it, forming thus a compound string from which a few notes of great beauty could be obtained. Mr. Hamilton, in attempting to complete a perfect instrument, soon found he had undertaken an almost impossible task, from difficulties which he explained to the Society. Failing to obtain advice or assistance, either from scientific men or from the musical instrument makers, he was once more thrown upon his own resources, and, conscious both of his responsibility and difficulties, resolved to leave for a time his university career, and to investigate to the uttermost a matter on which no information could be there obtained. The results of his investigations were then shown to the Society. After two years of labour, Mr. Hamilton had not only gained experience sufficient to perform what he had undertaken, but had also discovered that by a different mode of employing the same material, *i.e.* a string and a reed, he could secure for a string the advantages it afforded by an organ-pipe in addition to those which it already possessed. Showing a pianoforte string on a sound-board, he said: "Such strings already possess certain advantages; first, simplicity of reinforcement by a common sound-board; second, economy of space; third, blending of tone; and fourth, sympathy. Can I also secure for this string the advantages of an organ-pipe—namely, first, special reinforcement; second, volume of tone; third, choice of quality; and fourth, sustained sound?" Accordingly, an open diapason pipe was proposed for imitation, and, to the general surprise, the string was made to exactly imitate it in all these respects. Another string was next sounded, representing the note of the largest organ-pipe in use, in conjunction with other notes, satisfying the hearers that not only could a string do all the work of an organ-pipe in giving volume and sweetness to the note reinforced, but could afford the exquisite sympathetic and blending power hitherto peculiar to strings. Such notes were also sounded seven octaves apart. The reinforcement corresponding to the pipe was secured by the utilisation of a node which cut off from the string a segment corresponding to the note reinforced, presenting to all appearance the phenomenon of an organ built by nature out of a string. This node being a source of motion, is also utilised for gaining quickness of speech, since a cord, acting as a damper and stretched across the nodal line of a series of strings, serves to communicate instantaneous sound from key to key. Another invention of Mr. Hamilton's was a string which could not be put out of tune, to the great surprise of those who attempted to do so. He also exhibited a new pianoforte string, which by its purity and volume of tone showed that the results of a grand pianoforte could be obtained in a cottage instrument. Mr. Hamilton having satisfactorily answered several questions respecting possible objections, concluded by reminding the Society that it was in attempting faithfully to carry out the designs of another man that he was now in a position not only to perform what he had undertaken, but had also been permitted to bring into use a simpler, purer, and grander source of sound than had been contemplated when he laid his hand to a task which he was still engaged in perfecting.

Anthropological Institute, Nov. 24.—Prof. Busk, F.R.S., president, in the chair.—Col. Lane Fox exhibited and described specimens of stone implements, bows, arrows, and blowpipes from San José, Costa Rica. Mr. Charlesworth exhibited characteristic figures, carved in amalgam by Mexican miners, and a chaplet of gold and silver coins as worn by the women of Nazareth.—A brief paper by the late Mr. Cotesworth was read, On ruins in the neighbourhood of Palmyra; with Notes on some skulls found therein, by the President. The ruins described were groups of towers and tombs lying north and south of the Kuryelein road on the hills facing the castle. In one of these towers were discovered many skulls and other human remains, some of which were exhibited on the table. The date of their deposition could not, in the opinion of the author, be less than 1,800 to 2,000 years ago. There were also large underground tombs showing the same arrangements as in the towers. An examination of the remains by the President showed that they belonged to individuals of a dolichocephalic race of large rather than small stature, but by no means gigantic. A short time since Capt. Burton had forwarded skulls to the Institute presenting the same characteristics as the specimens under consideration.—Mr. W. Bollaert contributed Notes on some Peruvian antiquities, and exhibited a series of drawings and photographs in illustration, which he gave to the Institute.

MANCHESTER

Literary and Philosophical Society, Nov. 17.—Edward Schunck, F.R.S., president, in the chair.—Some remarks on Dalton's first table of atomic weights, by Prof. Henry E. Roscoe, F.R.S. This has already appeared in NATURE, vol. xi. p. 52.—Action of light on certain vanadium compounds, by Mr. James Gibbons.—On basic calcium chloride, by Harry Grimshaw, F.C.S.—On the structure of Stigmaria, by Prof. W. C. Williamson, F.R.S., which we hope to give next week.

PHILADELPHIA

Academy of Natural Sciences, July 21.—Dr. Ruschenberger, president, in the chair.—Prof. Persifor Frazer, jun., described a coal-cutting machine, designed by Mr. James Brown, of Brazil, Indiana. It consists of a steel or iron wheel, set in a frame, connected with the pneumatic engine, which runs in rails laid parallel to the face of the heading, which in this case may be several hundred yards long. On the outer periphery of this wheel are arranged twenty or thirty triangular-shaped pieces of steel, united with it at one of their apices by a pin. In the middle of the opposite side, which is curved, are firmly-fixed chilled-steel teeth, which set themselves by friction against the coal to the proper position for cutting, as the wheel is rotated to the right or left. The motion is imparted by means of a small-toothed wheel which moves in rack-work on the under-surface of the wheel.

July 28.—Dr. Ruschenberger, president, in the chair.—On report of the committees to which they had been referred, the following papers were ordered to be published:—Description of a new species of Helix, by James Lewis, M.D.—On some Batrachia and Nematognathi, brought from the Upper Amazon by Prof. Orton, by Edward D. Cope.—Notes on American Lepidoptera, with descriptions of twenty-one new species, by Aug. R. Grote.—Determination of the Species of Moths figured in the "Natural History of New York," by Aug. R. Grote, A.M.

Aug. 4.—Dr. Ruschenberger, president, in the chair.—Mr. Thomas Meehan exhibited some branches of *Acer Pennsylvanicum*, Lin. (*A. striatum*, Lamb), which had a remarkable system of dimorphic foliage. The first pair of leaves developed after the bursting of the bud in the spring, were larger and more perfectly developed than any subsequent ones. The next pair were usually lancelinear. Occasionally there was a tendency to the production of a pair of lobes, but usually the margins were